

REMARKS

Upon entry of the Amendment, Claims 1-2 and 4-14 will be pending in the application.

Claim 1 is amended to incorporate the subject matter of Claim 3, now canceled.

Nonelected method Claims 9-10 are withdrawn from consideration by the Examiner.

However, Applicants respectfully request rejoinder of these process claims upon subsequent allowance of the elected claims directed to the product (see MPEP §821.04), as the nonelected, withdrawn process claims can be readily amended to include all of the limitations of the allowable product claim.

Original Claims 4-5 and 7-8 are rewritten into independent form as these claims encompass allowable subject matter.

New Claims 11-14 are added to be dependent upon Claim 1 based on the subject matter in original Claims 4-5 and 7-8.

No new matter is added.

Entry of the Amendment is respectfully requested along with reconsideration and review of the claims on the merits.

Objection to Drawings

The Examiner asserts that Figures 1A and B should be designated by a legend such as -- Prior Art- because only that which is old is illustrated.

The Examiner asserts that Applicants' attempt to file corrected drawings on June 6, 2005 is not acceptable because the corrected drawing figures are entitled " Related Drawings [*sic* - Art]" whereas they should be entitled " Prior Art" (citing, e.g., MPEP 608.02(g)). The Examiner

makes this requirement Final, and states that Corrected drawings in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application .

Applicants respond as follows.

Applicants submit Corrected Drawings and a Replacement Sheet for Figs. 1A and 1B, now labeled as “Prior Art”, as suggested by the Examiner.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the objection to the drawings.

Allowable Subject Matter

Applicants appreciate the Examiner’s indication that Claims 4-5 and 7-8 include allowable subject matter which if rewritten in independent form (including all limitations) may be allowable.

In response, Applicants rewrite Claims 4-5 and 7-8 into independent form (including all limitations). New Claims 11-14 are added based on original Claims 4-5 and 7-8. Thus, allowance of at least these Claims 4-5 and 7-8 is earnestly requested.

Applicants submit that Claims 1-2, 4-8 and 11-14 are now patentable for at least the following reasons.

Claim Rejections Under 35 U.S.C. § 103

Claims 1 to 8 are rejected under 35 U.S.C. §103(a) as assertedly being unpatentable over Van Cleemput et al. (U.S. Patent No. 6,576,345) in view of Applicants' admitted prior art (hereinafter AAPR), for the reasons of record.

Applicants respond as follows.

Claim 1 is amended for clarification to recite a low dielectric constant film *consisting essentially of* a ladder-type hydrogen siloxane. Claim 1 is also amended to recite a protection film *consisting essentially of* a silicon oxide film, based on the subject matter of Claim 3, now canceled.

Applicants submit that even if the combination of Van Cleemput with Applicants' disclosure were proper, which Applicants respectfully deny, the combination of these references would still fail to render obvious the present invention.

Regarding the Examiner's characterization of Applicants' Admitted Prior Art (AAPR), Applicants submit that Figures 1A and 1B do not disclose a "protection film" of the present invention (see, for example, FIGURE 4, protection film elements 204 and 217). A barrier film (5) of Figures 1A and 1B would not be structurally equivalent to "a protection film consisting essentially of a silicon oxide film provided on said low dielectric constant film", as recited in present Claim 1. The barrier film (5) is constituted of Ta, TaN, Ti, TiN or layers thereof (see page 2, lines 15-17). On the other hand, Applicants recite that the protection film of the present invention consists essentially of a silicon oxide film (see page 6, lines 7-11 and page 17, line 1 and lines 18-19). The protection films of the present invention are also structurally different in physical location and purpose from the barrier film (5) of Figures 1A and 1B and barrier films (208, 226 and 220) of Figure 4.

Further, in each of Applicants' embodiments, the present invention provides for a semiconductor device comprising a semiconductor substrate and a low dielectric constant film consisting essentially of a *ladder-type hydrogen siloxane* formed on the semiconductor substrate

(see page 4, lines 4-10). Thus, Applicants specify that the low dielectric constant film (or low-k film) must be a “ladder-type hydrogen siloxane”, and those materials that do not materially affect the basic and novel characteristic(s) of the claimed invention. See MPEP §2111.03, and *In re Hertz*, 537 F.2d 549, 551-52, 190 USPQ 461, 463 (CCPA 1976). As one example, a ladder-type hydrogen siloxane can be L-OxTM.

Although Applicants use the transitional phrase “comprising” which is open-ended when defining the elements of the claimed semiconductor device, Applicants submit that when Applicants use the transitional phrase “consisting essentially of” in a clause of the body of a claim, rather than immediately following the preamble, it limits only the element set forth in that clause, even as other elements are not excluded from the claim as a whole. See MPEP §2111.03; and *Mannesmann Demag Corp. v. Engineered Metal Products Co.*, 793 F.2d 1279, 230 USPQ 45 (Fed. Cir. 1986). (the phrase “consists of” limits only the element set forth in that clause; other elements are not excluded from the claim as a whole when the transitional phrase “comprising” immediately follows the preamble.).

Applicants discovered that the structure of the present invention, including the use of a ladder-type hydrogen siloxane, provides the benefits of reducing interconnect capacitance, while also upgrading erosion resistance. (see page 4, lines 11-19; and Fig. 11).

On the other hand, Van Cleemput is directed to low k dielectric films formed from *caged-siloxane precursors* which are linked in such a way as to form dielectric layers, using supercritical fluids to dissolve and deliver the caged-siloxane precursors and to remove reagents and byproducts (see Abstract). Van Cleemput emphasizes the use of caged siloxane moieties in

its embodiments (see, for example, col. 3, lines 27-38; col. 4, lines 36-44; col. 5, lines 30-39; and col. 8, lines 24-46). A caged siloxane moiety is defined in Van Cleemput as a subunit of a caged siloxane precursor, that has as its molecular structure silicon atoms bridged to one another via oxygen atoms in such an arrangement so as to form a polyhedron, bowl-like, or any three dimensional form having an interior and exterior space associated with it (col. 8, lines 28-33; see also Fig. 5). Thus, Van Cleemput's disclosure of caged siloxane moieties fails to render obvious Applicants' invention.

Further, Van Cleemput actually teaches away from achieving Applicants' invention. Although Van Cleemput mentions "two-dimensional ladder-type" silsesquioxanes (siloxane) in the Background of the Invention section, such disclosure is coupled with the recognition that such silsesquioxanes are often brittle and the high temperature curing raises the dielectric constant in the final product (col. 2, lines 15-36). Thus, taken altogether, such disclosure in Van Cleemput clearly teaches against the use of a ladder-type hydrogen siloxane in favor of the three-dimensional caged-siloxane precursors.

On the other hand, Applicants describe the drawbacks of using a caged-siloxane film, such as a conventionally known HSQ film having a cage-type molecular structure. In the Description of the Related Art section, Applicants describe that the HSQ film, when employed as an interconnect insulating film, lacks good chemical resistance and mechanical strength such that the HSQ film is largely scraped off during a CMP process, leaving behind an extensive erosion region (see page 3, lines 6-18; Fig. 1B and Fig. 15). Thus, Applicants describe that a caged-siloxane film such as HSQ film lacks good chemical resistance and mechanical strength such that

a caged-siloxane film would materially affect the basic and novel characteristics of the claimed invention, reciting a low dielectric constant film consisting essentially of a ladder-type hydrogen siloxane provided on said semiconductor substrate”.

Applicants submit that Van Cleemput fails to disclose or teach at least the low dielectric constant film consisting essentially of a ladder-type hydrogen siloxane of the present invention. Thus, it would not have been obvious to require the use of a low dielectric constant film consisting essentially of a ladder-type hydrogen siloxane formed on the semiconductor substrate and a protection film consisting essentially of a silicon oxide film provided on the low dielectric constant film, in the present invention.

Accordingly, Applicants respectfully request reconsideration and withdrawal of the rejection under 35 U.S.C. § 103(a).

Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

AMENDMENT UNDER 37 C.F.R. § 1.116
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Respectfully submitted,

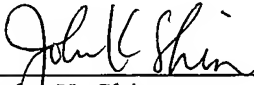
SUGHRUE MION, PLLC
Telephone: (202) 293-7060
Facsimile: (202) 293-7860

WASHINGTON OFFICE

23373

CUSTOMER NUMBER

Date: November 22, 2005



John K. Shin
Registration No. 48,409

